

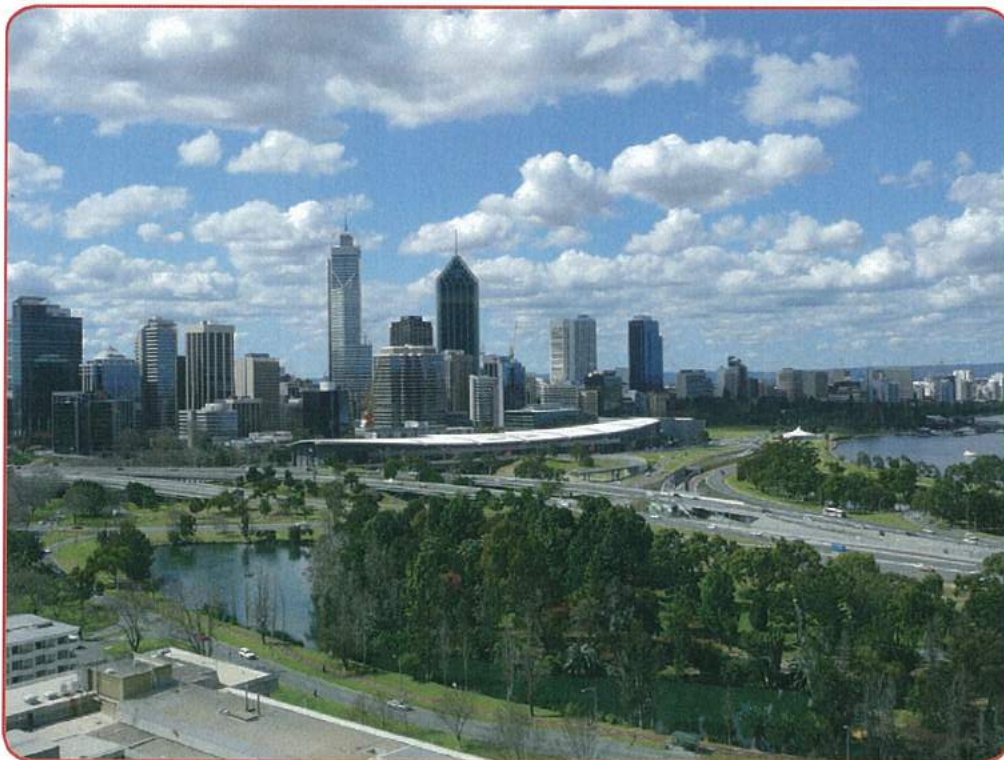
# Mitchell Freeway Stage 1

## National Engineering Landmark Award

### Unveiling Ceremony

Tuesday 18<sup>th</sup> November 2008

Engineers Australia WA Division



PROGRAM BOOKLET

# Program

## Welcome and Introduction to Heritage Recognition Program

Don Young FIEAust CPEng  
Chairman, Engineering Heritage Panel  
Engineers Australia, WA Division

## History of the Mitchell Freeway Stage 1

Lorie Jones FIEAust CPEng  
President  
Engineers Australia, WA Division

## Unveiling of National Engineering Landmark Plaque

His Excellency Dr Ken Michael AC Hon FIEAust  
Governor of Western Australia

## Acceptance of Plaque and Vote of Thanks

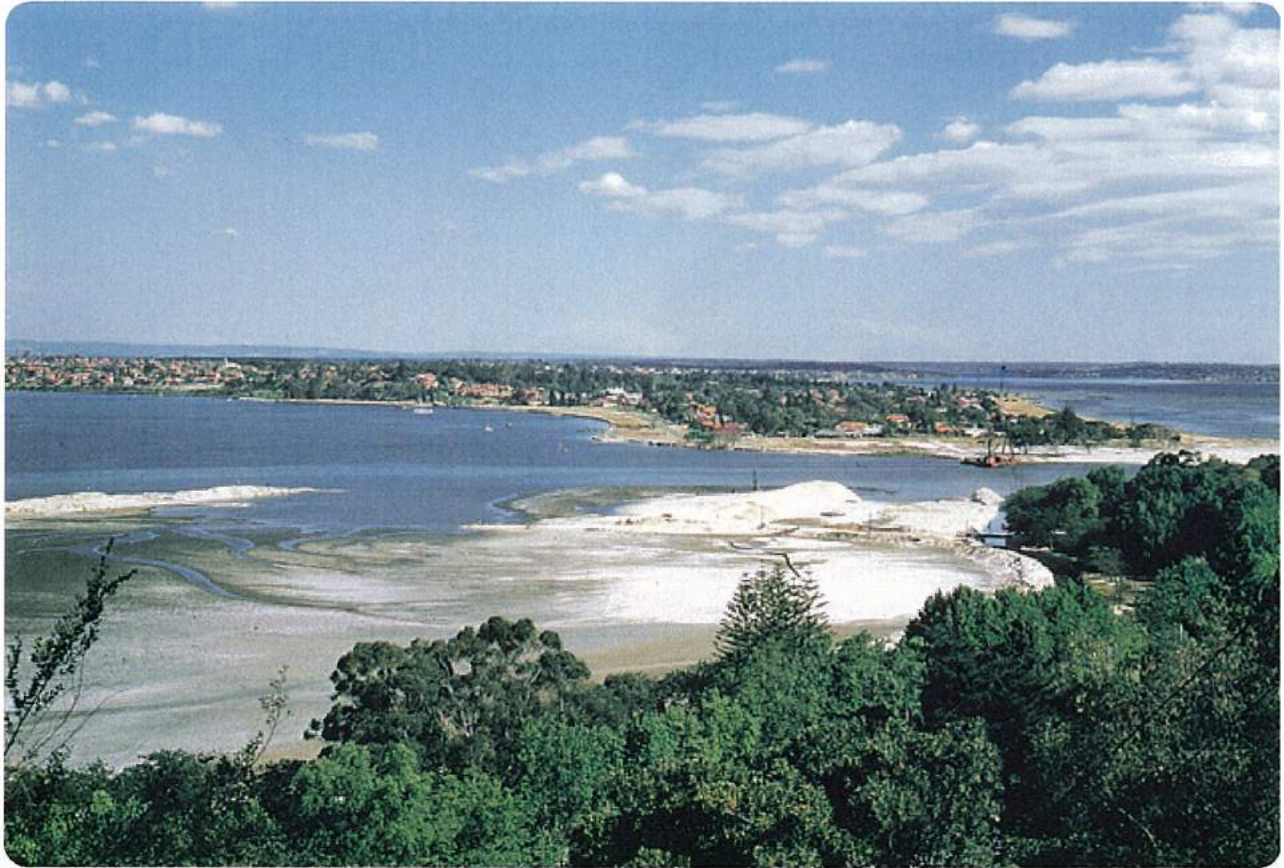
Menno Henneveld FIEAust CPEng  
Commissioner  
Main Roads Western Australia

## Lunch





# Mitchell Freeway History



Narrows Interchange Site ca 1956

The Mitchell Freeway began as part of the Stephenson Metropolitan Region Scheme in the mid 1950's. Its original proposed name was the Yanchep Highway, as this is where the freeway was (and still is) planned to end. The section between the Narrows Bridge and Sutherland Street, construction of which commenced in 1966 and was completed in 1973, was referred to as "the western switch". It subsequently became known as the Mitchell Freeway Stage 1 and served only as a distributor for Narrows Bridge traffic into the CBD or areas further north and west.

The freeway was extended in stages from the late 1970's onwards. It is currently being extended to Burns Beach road. By 2020, depending on the timing of future developments, such as the Alkimos/Eglinton

Satellite City, the freeway could reach Two Rocks.

Mitchell Freeway Stage 1 consists of three sections; the Narrows Interchange, the Central Section ( between Mount and Murray Streets ), and the Hamilton Interchange.

## The Barracks Arch

In 1965 work commenced on demolishing buildings to provide a 100 metre wide clear strip through western Perth to allow construction of the Central Section. The most important building to be removed was the Barracks, a landmark Perth building dating back to the colonial era. There was a vehement public outcry over the removal of the Barracks structures which lead to a compromise, the



retention of the Barracks Arch. This structure stands as a symbol of the beginning of an increased awareness of the value of preserving the built heritage in Western Australia.



Barracks Arch from Parliament House

## Foundation Problems of the Narrows Interchange Site

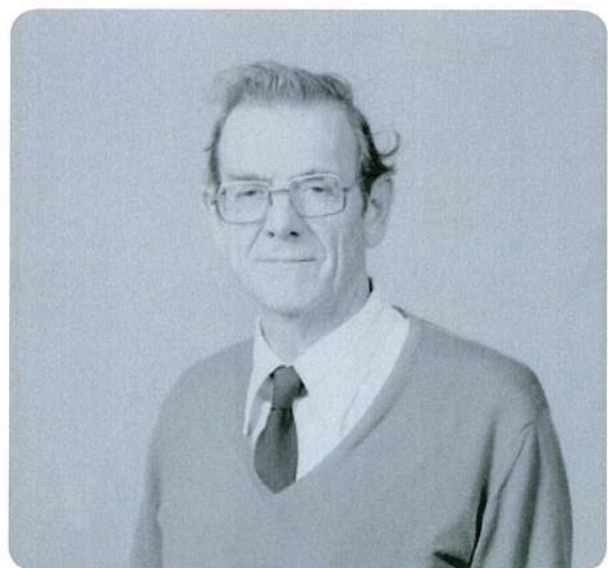
The most difficult part of Stage 1 to design and construct was the Narrows Interchange. Soon after the Narrows Bridge was completed in 1959 work started on planning for the preparation of the interchange site for bridge and road construction, Mounts Bay having previously been reclaimed by dredging. During the Narrows Bridge construction sideways movements of the compressed underlying mud layer in reclaimed Mounts Bay were detected at the bridge site, resulting in a re-design of the north shore pier foundations. The original design provided for tubular steel piles driven to bedrock and then filled with cast insitu reinforced concrete. The revised design used larger diameter driven tubular steel piles with lesser diameter precast concrete pier support columns grouted into the base of the piles. The annular space provided isolated the support columns from the consequences of possible future ground movements.

In 1961 Main Roads Bridge Engineer Mr Gilbert Marsh spent twelve months in the UK, where among other things, he undertook

studies in soil mechanics at Imperial College, London, under Professor Sir Alec Skempton. His particular interest was in techniques which could be used for the rapid consolidation of the mud layers under the future Narrows Interchange site.

On returning to Perth in 1962 Mr Marsh initiated a trial of sand draining techniques in the mud layer of the Narrows Interchange area. The success of this trial convinced Main Roads that the whole of the interchange area could be adequately consolidated to support the high road embankments within the interchange.

Commencing in 1964 Main Roads carried out, over a four year period, an extensive stabilisation of a 37 hectare reclaimed area north of the Narrows Bridge. This was done by the installation of 43,000 vertical sand drains, about 800 km in length. Approximately three million cubic metres of sand was trucked to the site to consolidate the mud and provide material for the embankments. The average consolidation was six metres. The scale of this stabilisation process was unique in Australian, and probably in the world, civil engineering construction at the time.



J G [Gilbert] Marsh, Bridge Engineer, Main Roads 1957 to 1985



## Design Development

The Narrows Interchange was designed by Main Roads staff. The Central Section and Hamilton Interchange were designed by De Leuw Cather of Chicago, which also had specific expertise in geometric road design, with selected Main Roads staff as part of the design team.

### The Narrows Interchange

The Narrows Interchange presented special foundation design considerations. Despite the success of the foundation consolidation process by sand draining and surcharge it was anticipated that there would be further long term vertical and horizontal subsurface movements. As a consequence the bridge foundations consisted of hollow cast insitu concrete caissons sunk to bedrock with the bridge support piers built within the caissons. The annular space isolated the bridge piers from future ground movements. The combined length of the thirteen caissons was approximately 450 metres. The average mass and length of the caissons is 2000 tonnes and 34.5 metres respectively, diameters varying between 7.4 and 10.8 metres. In total 41,000 cubic metres of concrete was used in the foundations and superstructures and 1222 tonnes of high tensile steel were used in 4600 prestressing cables required for the project. The interchange superstructures consisted of 26,550 square metres of prestressed concrete bridge deck and 29.4 kms of freeway standard road pavements were constructed.

### The Central Section

The Central Section comprised three reinforced concrete cast insitu box girder bridges supported on reinforced concrete piers. The Murray Street bridge had piled foundations.

A deep cutting through the built-up area required 230,000 cubic metres of excavation and 1800 lineal metres of retaining walls, varying in height up to 6.6 metres.

### The Hamilton Interchange

Connecting to the northern end of the Central Section the Hamilton Interchange consisted of cast insitu post tensioned box girder bridges over Wellington, Roe, Aberdeen and James Streets and the Perth to Fremantle railway. Compacted pile foundations were used. These bridges were unique in Western Australia in that it was the first time that large multi wire prestressing cables, requiring a 500 tonne capacity prestressing jack, had been used.

### Historical Notes

On 18 November 1966 a ceremony was held at the Murray Street bridge site when the then Premier of Western Australia, the Hon. David Brand MLA, pulled a lever to begin the first concrete pour on the Central Section. He then unveiled a plaque which was subsequently fixed to a Murray Street bridge retaining wall and unveiled by Lady Brand, widow of Sir David, on 18 November 1982.



Unveiling Ceremony 18 November 1966. Left to Right Hon Ross Hutchison DFC MLA, Minister for Works; Mr D H Aitken, Commissioner of Main Roads; Hon David Brand MLA, Premier





The 1966 plaque



Mr D H [Don] Aitken, Commissioner of Main Roads 1965 to 1987

## Construction Contracts

Whereas the foundation consolidation of the Narrows Interchange area was supervised by Main Roads staff on a direct hire labour and material basis most of Stage 1 work was let to construction contractors.

The first contract, for the Central Section, was awarded to a joint venture of Clough Engineering and Kier Ltd a UK based company. The \$2.4 million contract was awarded in

March 1966 and was completed on time two years later. The work comprised Malcolm Street, Hay Street and Murray Street bridges, retaining walls and freeway and street pavements.

A \$5.2 million contract for the foundations of the Narrows Interchange bridges was awarded to Citra Australia in June 1969 and a further \$6.4 million contract for the bridge superstructures was let to the same company in August 1970. The Narrows Interchange bridges and roads were officially opened by the Premier of Western Australia, the Hon John Tonkin MLA on 30 November 1973, almost nine years after the first sand drain had been installed on site and nineteen years after reclamation of Mounts Bay had commenced.



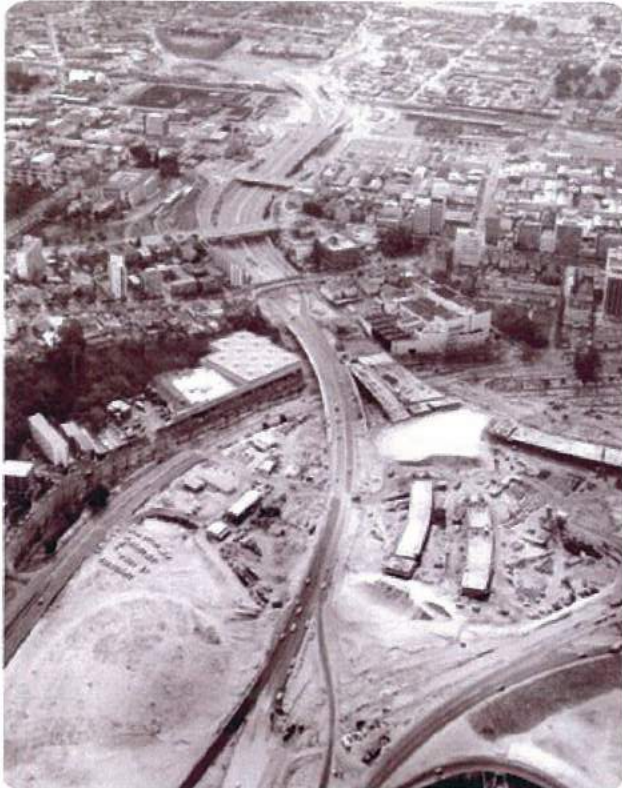
Central Section under construction in 1968

PDC Constructions Pty Ltd was awarded a \$2.4 million contract to construct the first stage of the Hamilton Interchange in October 1969. The work scope included multiple bridges over Wellington and Roe Streets and the Perth to



Fremantle railway line and road pavements extending from Murray Street to Charles and Sutherland streets.

A further contract, valued at \$1.9 million was awarded to PDC Constructions for bridges over Aberdeen and James streets and a second bridge over the railway line.



Narrows Interchange under construction in 1972



Mr M W [Mike] Parsons, Main Roads Engineer in Charge of Construction

## Landscaping

In 1964 the then Commissioner, Mr John Punch, set up an advisory committee chaired by Professor Gordon Stephenson to provide advice as to how the Narrows Interchange area should be landscaped. This committee reviewed the plans of Mr John Oldham, a Public Works Department landscape architect. As a result a scenic lake was created and lawns, trees and shrubs planted and pedestrian footpaths and underpasses constructed. The result was a network of pathways allowing people to access the landscaped areas and the creation of a pleasing vista from Kings Park. Similar planning allowed for the creation of access paths and vegetated verges behind the retaining walls of the Central Section.

## Acknowledgements

Engineers Australia through Engineering Heritage Australia administers the Australian Heritage Engineering Recognition Program, commemorating outstanding engineering achievements and has this year judged the Mitchell Freeway Stage 1 to be worthy of its highest accolade, the National Engineering Landmark. The Engineering Heritage Panel of Engineers Australia WA Division wishes to acknowledge that it has extensively used in the preparation of this program material from The Vital Link, A History of Main Roads Western Australia 1926 – 1996 by Leigh Edmonds. Other sources of information were a Main Roads publication, Making a Start on Mitchell Freeway and Main Roads annual report 1969-1970. The assistance and support of Commissioner Menno Henneveld, Mr Dean Roberts and Ms Jo Vinci all of the Main Roads is also gratefully acknowledged.

**Don Young FIEAust CPEng**



National Engineering Landmark Plaque



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